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ABSTRACT

This document defines what are considered to be the essentials in a strong mathematics program for the state of Oregon for grades K-12. The common curriculum goals are organized into nine content strands: (1) number and numeration; (2) appropriate computational skills; (3) problem solving; (4) geometry and visualization skills; (5) measurement; (6) statistics and probability; (7) mathematical relationships; (8) oral and written communication skills; and (9) appropriate study skills. Each strand contains knowledge and skills to be developed with expected outcomes for students to achieve by grades 3, 5, 8, and 11. (RH)

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MATHEMATICS

Common Curriculum Goals

October 1987

Oregon Department of Education
700 Pringle Parkway SE
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Verne A. Duncan
State Superintendent of Public Instruction

Oregon Schools — A Tradition of Excellence

Adopted by the State Board of Education September 18, 1987

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FOREWORD

In June 1984 the State Board of Education adopted the Oregon Action Plan for Excellence which established the direction for school improvement in the state over the next decade. The Action Plan drew upon the insights of teachers, administrators, school board members and community and business leaders.

A central concept of the Action Plan is that while the state will determine WHAT must be taught in public schools, the schools will determine HOW it will be taught. This document is intended to provide the essential information which local districts need to merge state curriculum expectations with their own local determinations for Mathematics.

All who have joined in the spirit of the Action Plan for Excellence have shared a commitment to high-quality performance. We are continuing to learn about how to provide children with the very best in public education, and we welcome your comments and questions. For further information about this guide, contact the Specialist for Mathematics Education, 378-3566.

Verne A. Duncan
State Superintendent
of Public Instruction

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Two major curriculum documents served as the primary basis for the development of this publication: (1) Essential Learning Skills and (2) The Oregon Mathematics Concept Papers. The concept papers were developed as an Oregon Mathematics Education Council (OMEC) curriculum project. Nearly 100 volunteers worked on their own time for about two years in study, debate, presentations and writing. Their conclusions present "forward-looking" ideas for school mathematics. Their names and schools at the time the OMEC Curriculum Project was launched are listed below.

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INTRODUCTION

THE OREGON ACTION PLAN FOR EXCELLENCE

The Action Plan identified seven areas of improvement, one of which called for a statewide definition of what students should learn:

> The Oregon Department of Education, working with local school districts and higher education institutions, shall define the required ***common curriculum goals*** for elementary and secondary schools in terms of the learning skills and knowledge students are expected to possess as a result of their schooling experience.
>
> Local school districts, with assistance from the Oregon Department of Education, shall be responsible for organizing the curriculum and delivering instruction to achieve the ***common curriculum goals***.

Common Curriculum Goals

The first stage in defining the Common Curriculum Goals was to develop the ***Essential Learning Skills*** — the basic skill and performance expectations for all students in the areas of reading, writing, speaking, listening, mathematics, reasoning and study skills. The second and present state is to develop Common Knowledge and Skills in individual subject areas. Together with the ***Essential Learning Skills***, they form the Common Curriculum Goals for all students.

A. Essential Learning Skills

The ***Essential Learning Skills*** are considered basic to all students' learning, and all teachers are expected to provide instruction in these skills. Only to the degree that students develop these skills and form the habit of using them, can instruction in subject matter areas be successful. The skills are not specific to any one discipline but provide a link across all disciplines. Furthermore, the skills do not grow in isolation from content; they are strengthened through practice and use in all subject areas.

B. Common Knowledge and Skills

Looking beyond the ***Essential Learning Skills***, this document defines more fully what are considered to be the essentials in a strong Mathematics program. Each district will want to extend and elaborate upon this base in order to create its own unique, comprehensive mathematics curriculum. Students should have the opportunity to demonstrate their achievement in a variety of ways. Equal opportunity to learn and the special needs of students are primary considerations in determining acceptable performance levels.

State Standards

The Common Curriculum Goals as presented in this document receive their authority from the Oregon State Standards for Public Schools, OAR 581-22-420 and 581-22-425. These rules were amended by the State Board of Education in January 1986.

PHILOSOPHY/RATIONALE UNDERLYING THIS CURRICULUM

The 1980s have been a time of educational reform in the nation at large. There has been a strong and pervasive quest for excellence and equity in education in general, and mathematics education in specific. The Oregon Action Plan for Excellence established the direction for school improvement in the state and the ***Essential Learning Skills*** document outlined the common skills across all program areas for elementary and secondary education. This document, *Mathematics: Common Curriculum Goals*, is written in relationship to the preceding documents specifically, as well as to the reform effort generally.

Although the underlying principles of mathematics are constant, the optimum structure for the presentation and use of mathematics has been shifting in response to the rapidly expanding importance of technology in solving problems. Today's world demands the ability to think and use mathematical ideas to solve problems and to make decisions. The time our pupils spend learning mathematics can no longer be limited to practicing long, repetitive or tedious procedures which are more efficiently done with calculators. The impact of technology and its implications for mathematics education are reflected in this document.

The increasingly common uses of calculators underlines the need for mental computations and estimations. Although the development of these skills has always been implicit in mathematics instruction, they have not always been taught systematically and fully. Deliberate and thorough development of the ability to estimate and do mental arithmetic is a regular part of the computational strand at all school levels in the curriculum outlined in this document.

Even though the calculator is becoming an increasingly available tool for problem solving, its use is of little value if the user has inadequate conceptual understandings of number and operation. To help students understand "which buttons to push," the curriculum must place significant emphasis on the concepts which underlie basic mathematical skills. Increasingly, research supports the use of concrete materials as models for number concepts and for operations. The curriculum outlined in this document provides that a broad range of manipulatives be used to introduce new concepts at all levels. In addition to going from concrete to the abstract, opportunities are provided for finding concrete representations for abstract concepts and their symbolic representations. The use of manipulatives as tools for increasing understandings extends naturally to their use as tools to assist in learning problem-solving skills. The use of concrete materials as problem-solving tools is incorporated into a variety of curriculum content areas as outlined in this document.

As hardware becomes both more sophisticated and less expensive and as software development continues to expand and become more "user friendly," computers will inevitably become major tools for mathematics education. The value of computers in creating geometric displays, organizing and graphing data, simulating real-life situations, and generating numerical sequences is recognized in this document.

Mathematics is about making sense of the world. The mathematics outlined in this document is consistent with the nature of the subject. This means that pupils are learning mathematics in ways that allow them to explore relationships and to develop understandings. The fundamental premise on which this document is based is that every aspect of school mathematics that pupils encounter should enhance their understanding of mathematical ideas and promote the growth of thinking.

Organization

In order to provide a curriculum consistent with the philosophy outlined above, the common curriculum goals for math have been organized into nine content strands. They are:

1.0 Number and Numeration. Students demonstrate an understanding of number and numeration concepts and use these understandings to interpret and solve problems.

2.0 Appropriate Computational Skills. Students select and use the most appropriate form of computation — manipulative, mental, paper/pencil, estimation or calculator usage to solve problems and will check all computations for reasonability.

3.0 Problem Solving. Students use problem-solving skills and strategies to solve routine and nonroutine problems.

4.0 Geometry and Visualization Skills. Students recognize geometric patterns and relationships and apply them in solving problems and making predictions.

5.0 Measurement. Students measure quantities and use measurements to keep records, solve problems and make predictions.

6.0 Statistics and Probability. Students collect, organize, record and interpret data, and predict probable outcomes based on collected data.

7.0 Mathematical Relationships. Students recognize and use number patterns, relationships and logical thinking skills to make predictions and to solve problems.

8.0 Oral and Written Communication Skills. Students use vocabulary, speech, numerals and other symbol systems essential for effective individual and group problem solving, and for effective oral and written communication of mathematical concepts, problem-solving processes and results.

9.0 Appropriate Study Skills. Students will be able to select and use appropriate study skills in order to accomplish mathematical learning tasks.

The content outlined in each content strand includes both the essential learning skills deemed appropriate for mathematics instruction and the common curriculum outcomes unique to mathematics. It is very important to remember that the student outcomes appearing in the columns headed Grade 3, Grade 5, Grade 8 and Grade 11 are expectancies for students to reach by the end of these grade levels. An expectancy appearing in the Grade 3 column, for example, represents a goal to be achieved as a result of four years of learning. Another Oregon Department of Education publication, "A Model Comprehensive Mathematics Program," will suggest developmental stages for each grade.

COMMON CURRICULUM GOALS

The content of mathematics programs is organized under nine content strands. This section presents a brief summary and rationale followed by the common curriculum goals for each strand.

Number and Numeration: Basic Concepts, Principles and Meanings

The mastery of a particular bit or area of knowledge at a level that makes it genuinely functional in one's life requires that it be *understood* thoroughly, that it be connected to related bodies of thought, and that it be integrated with other knowledge/attitudes/perceptions the student holds.

Specifically applied to mathematics, this means that students need to apply in a conscious way the basics of number and numeration if they are to be masterful users of the algorithms they are learning. To assist in this objective the mathematics content provides opportunities to build concepts and demonstrate understandings through the use of concrete models for whole number, fraction and decimal numerations.

1.0: Number and Numeration. Students demonstrate an understanding of number and numeration concepts and use these understandings to interpret and solve problems.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
1.1 **READ, WRITE, ORDER, COMPARE AND USE NUMBERS*** (ELS 1.4)**	[a]Read and write whole numbers to **1,000**, commonly used fractions (½, ⅓, 1/10), and decimals in tenths and hundredths **(using a money model)**	[a]Read and write whole numbers to one million; commonly used proper fractions, mixed numbers, **and** improper fractions; and decimals to thousandths	[a]Read and write numbers, including decimals, commonly used fractions and percents	[a]Read, write and order numbers including decimals, commonly used fractions, percents and numbers in scientific notation
	[b]Demonstrate the counting skills of skip counting by 2, 5 and 10; "counting on" and counting backwards to and from 100	**[b]Demonstrate skip counting skills**	**[b]Express large numbers in expanded exponential notation**	**[b]Express large and small numbers in expanded exponential notation**
			[c]Order signed numbers and commonly used fractions, decimals and percents	**[c]Order signed numbers and commonly used fractions, decimals and percents**
			[d]Express large whole numbers in scientific notation	

* The additional outcomes for mathematics, both in the skill column and the grade level expectancies, are in bold print to distinguish them from the Essential Learning Skills.

** Learning outcomes drawn from the *ODE Essential Learning Skills* document are cross-referenced by citing their original identifying number in parentheses. Any modification in the original wording is indicated by bold print.

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
1.2 USE CONCRETE AND PICTORIAL MODELS TO DEMONSTRATE NUMBER AND NUMERATION CONCEPTS (ELS 1.4)	[a]Order, compare and model (demonstrate comprehension by use of objects or a drawing) place values to 1000, commonly used fractions and decimals (using money models) in tenths and hundredths	[a]Order, compare and model place values to one million; commonly used fractions and decimals to thousandths, and use concrete and pictorial models to demonstrate an understanding of the above	[a]Order, compare and model commonly used fractions, decimals, percents and signed numbers, and give examples of positive and negative quantities (e.g., temperature, football, bank balances, altitude)	[a]Order, compare and model commonly used fractions, decimals, percents and signed numbers, and give examples of positive and negative quantities (e.g., temperature, football, bank balances, altitude)
	[b]Identify the number of ones, tens and hundreds in numbers less than 1000 and use concrete models to demonstrate understanding	[b]Identify the number of ones, tens, hundreds and thousands in numbers less than one million, and tenths, hundredths and thousandths in numbers less than one	[b]Identify the number of ones, tens, hundreds, thousands, ten-thousands, and hundred-thousands in numbers less than one million, and tenths, hundredths and thousandths in numbers less than one	[b]Identify the number of ones, tens, hundreds, thousands, ten-thousands, and hundred-thousands in numbers less than one million, and tenths, hundredths and thousandths in numbers less than one
1.3 RECOGNIZE AND USE NUMBER PROPERTY CONCEPTS	[a]Demonstrate, use and apply the properties of addition and subtraction	[a]Demonstrate, use and apply the properties of addition, subtraction, multiplication and division with whole numbers	[a]Use and apply the properties of addition, subtraction, multiplication and division with whole numbers and positive rational numbers, and demonstrate the properties of one and zero (including nondivision by zero), and the closure property	[a]Use and apply operational properties
			[b]Recognize and use mathematical terms	[b]Recognize and use mathematical terms
			[c]Explain the reasons for the rules for order of operations and use of grouping symbols	[c]Use and apply order of operations rules as appropriate for mental, paper/pencil and calculator usage

Appropriate Computational Skills

Mastery of computational skills is a necessary outcome of a mathematics program. Computational skills need to be related to real-world situations and seen as a means of enhancing a person's ability to use mathematics in daily living. Memorization of all one-digit basic facts at the quick recall level is imperative. Computational skills include mental arithmetic, estimation and calculator use as well as paper/pencil computation. Instruction should include opportunities to select which mode of computation is more appropriate and to determine whether or not answers are reasonable. Furthermore, the instructional content provides opportunities to demonstrate conceptual understandings and reasonability of answers through the use of concrete models and materials.

2.0: Appropriate Computational Skills. Students select and use the most appropriate form of computation — manipulative, mental, paper/pencil, estimation or calculator usage to solve problems and check all computations for reasonability.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
2.1 USE MENTAL, PAPER AND PENCIL, ESTIMATION AND CALCULATOR COMPUTATIONS TO SOLVE APPROPRIATE PROBLEMS (ELS 1.4 and 1.7)	[a]Use mental, manual or calculator processes to perform grade-level arithmetic operations	[a]Use mental, manual or calculator processes to perform grade-level arithmetic operations	[a]Use mental, manual, calculator and computer processes to perform mathematical operations	[a]Use mental, manual, calculator and computer processes to perform mathematical operations
	[b]Select the most appropriate method of computation (manipulative, mental, paper/pencil, calculator) to use in a given situation	**[b]Select the most appropriate method(s) of computation (manipulative, mental, paper/pencil, calculator) to use in a given situation**	**[b]Select the most appropriate method(s) of computation (mental, paper/pencil, calculator) to use in a given situation**	**[b]Select the most appropriate method(s) of computation (mental, paper/pencil, calculator) to use in a given situation**
	[c]Use estimating skills, such as rounding, to make approximate whole number computations	**[c]Use rounding and other techniques useful in mental computation to estimate and make approximate whole number, fraction and decimal computations**	**[c]Use rounding and other techniques useful in mental computation to estimate and make approximate whole number, fraction, decimal and percent computations**	**[c]Use and apply estimation techniques**
	[d]Apply acquired strategies including modeling patterns (such as "counting on," "doubles," "neighbors," etc.) and properties (commutativity and associativity), to aid in quick recall of addition, subtraction and multiplication facts	**[d]Apply acquired strategies to aid in quick recall of all basic facts**		
	[e]Solve mentally, appropriate addition and subtraction problems involving place value understanding, e.g., add or subtract 10 or 100 to (from) any 3-digit number; add or subtract multiples of 10 or 100	**[e]Solve mentally, appropriate whole number, fraction and decimal problems, e.g., 10×64; 60×20; $14{,}000 - 7{,}000$; $5{,}000 + 261$; $3{,}000 \times 7$; $1/4 + 3/4$; $5/8 - 4/8$; $3 - 0.5$**	**[e]Mentally $+, -, \times, \div$ whole numbers and decimals by powers of ten and multiples of ten**	

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
	[f]Perform addition and subtraction algorithms with and without regrouping using 1-3 digit whole numbers	[f]Use paper/pencil to perform addition, subtraction, multiplication of whole numbers, 1-digit division, addition and subtraction of decimals, addition and subtraction of fractions with like denominators	[f]Recognize that the same arithmetic algorithms used with 1-3 digit numbers can be extended to multidigit computations	[f]Recognize that the same arithmetic algorithms used with 1-3 digit numbers can be extended to multidigit computations
		[g]Compute using measures of length, weight (mass), time and money	[g]Compute using measures	[g]Compute using measures
	[h]Use a calculator to solve appropriate problems and to check approximate calculations (e.g., real problems with lengthy calculations or large numbers)	[h]Use calculator and/or computer to solve appropriate problems	[h]Use calculator and/or computer to solve appropriate problems	[h]Use calculator and/or computer to solve appropriate problems
				[i]Convert mentally, manually and electronically among decimals, percents and commonly used fractions
	[i]Use estimation and other skills to check answers for reasonableness	[i]Use estimation and other skills to check answers for reasonableness	[i]Use estimation and other skills to check answers for reasonableness	[i]Use estimation and other skills to check answers for reasonableness
2.2 DEMONSTRATE COMPUTATIONAL ALGORITHMS WITH CONCRETE MATERIALS OR REAL-WORLD EXAMPLES	[a]Use concrete models to perform whole number computations, and demonstrate place value exchanges (borrowing and carrying) up to 1000 and to model the various meanings of multiplication	[a]Use concrete materials to model the various meanings of multiplication and division and to interpret remainders	[a]Demonstrate an understanding of the various meanings of multiplication and division (including remainders) of whole numbers by drawings or by referencing "real world" applications	
			[b]Model the various meanings of addition and subtraction involving signed numbers, and add, subtract and multiply signed numbers in situations meaningful to students	[b]Use concrete or pictorial models to demonstrate addition, subtraction and multiplication of signed numbers

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
		[c]Use models such as money or metrics to demonstrate addition, subtraction and multiplication of decimals by whole numbers	[c]Use concrete materials or "real world" examples to demonstrate operations with decimals and percents	[c]Use concrete materials or "real world" examples to demonstrate operations with decimals and percents
		[d]Use concrete models to demonstrate addition and subtraction of commonly used fractions	[d]Use concrete materials or "real world" examples to demonstrate operations with commonly used fractions	[d]Use concrete materials or "real world" examples to demonstrate operations with commonly used fractions

Problem Solving

Problem solving has been designated as the central goal for mathematics. A problem is a perplexing situation in which an individual or group accepts the challenge of finding ways to clarify or resolve the difficulties involved. Frequently, the problem can be approached in many ways. Occasionally, the resulting investigations are nonproductive. Sometimes they are so productive as to lead to many different solutions or suggest more problems to solve.

Problem-solving skills and strategies should be explicitly emphasized and problem solving should be incorporated frequently into the approaches used in teaching the required topics throughout the grade levels.

3.0: Problem Solving. Students use problem-solving skills and strategies to solve routine and nonroutine problems.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
3.1 IDENTIFY PROBLEMS AND APPROACH THEIR SOLUTION IN AN ORGANIZED MANNER (ELS 6.3)	[a]Identify problems that need a solution	[a]Identify problems, recognize information necessary to solve problems, and supply additional information if needed.	[a]Define a problem, choose information to solve the problem and supply additional information, if needed	[a]Define a problem, choose information to solve the problem and supply additional information, if needed
	[b]**Use simple questioning to clarify problems**	[b]Use simple questioning strategies to clarify problems	[b]Use a combination of questioning strategies and observation to analyze problems	[b]Apply recognized research techniques to **analyze** problems
	[c]**Use data from questioning to develop a problem-solving plan**	[c]Use data from the questioning process to develop a problem-solving plan	[c]Use data from several sources to develop a problem-solving plan	[c]Design and carry out a plan for solving a problem
	[d]Solve problems using strategies such as guessing and checking, using concrete objects, making a model, generating a pattern or drawing a picture	[d]Solve problems using a variety of strategies such as guessing and checking, making predictions based upon a pattern, making a drawing or model	[d]Solve problems using appropriate strategies such as guessing and checking, making a systematic list, looking for patterns, making or drawing a model, eliminating possible answers or solving a simpler problem	[d]Solve problems using the most appropriate tools, methodologies, processes and operations in solving a variety of problems
	[e]Identify alternative solutions to a simple problem	[e]**Identify alternative solutions to problems**	[e]**Identify alternative solutions to problems**	[e]**Identify alternative solutions to problems**
	[f]Choose and apply mental, manual and calculator processes to problem-solving strategy(ies)	[f]Choose and apply mental, manual and calculator processes to problem-solving strategy(ies)	[f]Choose and apply mental, manual, calculator and computer processes to problem-solving strategy(ies)	[f]Choose and apply mental, manual, calculator and computer processes to problem-solving strategy(ies)
			[g]**Select and apply appropriate problem-solving tools, including computer software**	[g]**Select and apply appropriate problem-solving tools, including computer software**

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
	[b]**Share successful and unsuccessful problem-solving strategies**	[b]Share successful and unsuccessful problem-solving strategies	[b]Describe both successful and unsuccessful solution strategies	[b]Evaluate problem-solving strategies in terms of tools, methodologies, processes, operations
	[f]Engage in cooperative problem solving and compare alternative solution strategies	[f]Engage in cooperative problem solving and compare alternative solution strategies	[f]Engage in cooperative problem solving and compare alternative solution strategies	[f]Engage in cooperative problem solving and compare alternative solution strategies
	[f]Develop new suggestions or approaches if problem is not solved	[f]Use formative (in process) data to modify or confirm problem-solving plan	[f]Use summative (final) data to determine if the problem-solving approach was successful, and if not, how it should be modified	[f]Analyze formative and summative data to confirm or revise the proposed solution
3.2 CREATE AND SOLVE WORD PROBLEMS APPROPRIATE TO THE GRADE LEVEL (ELS 6.3)	[a]**Recognize appropriate operation(s) (+, −, ×) for solutions of word problems**	[a]**Recognize appropriate operation(s) for solutions of word problems and recognize information necessary to solve word problems, and supply reasonable additional information, if needed**	[a]**Recognize appropriate operation(s) for solutions of word problems and recognize information necessary to solve word problems, and supply reasonable additional information, if needed**	[a]**Recognize appropriate operation(s) for solutions of word problems and recognize information necessary to solve word problems, and supply reasonable additional information, if needed**
	[b]**Solve one-step word problems including those involving money, measurement and data presented in graphs, tables and charts**	[b]**Solve one- and two-step word problems including those involving money, measurement and data presented in graphs, tables and charts**	[b]**Pose and solve multiple-step word problems**	[b]**Pose and solve word problems**
	[c]**Create word problems to match addition, subtraction and multiplication algorithms**	[c]**Create word problems to match whole number, fraction and decimal algorithms**	[c]**Solve and create word problems to match exercises involving whole numbers, fractions, decimals and percent**	[c]**Solve and create problems to match exercises involving ratios, proportions and formulas**
			[d]**Identify, invent or create problems that can be solved by using ratio and proportion; and use proportion to solve problems**	[d]**Identify, invent or create problems that can be solved by using ratio and proportion; and use proportion to solve problems**

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
	*Solve problems with more than one possible solution and recognize problems which cannot be solved because they contain too little information	*Solve problems with more than one possible solution and recognize problems which cannot be solved because they contain too little information	*Solve problems with more than one possible solution and recognize problems which cannot be solved because they contain too little information	*Solve problems with more than one possible solution and recognize problems which cannot be solved because they contain too little information
			†Translate "real-world" problems into mathematical statements, and mathematical problems and answers back into "real-world" context	†Translate "real-world" problems into mathematical statements, and mathematical problems and answers back into "real-world" context

Geometry and Visualization Skills

We live on a sphere called Earth and work in a three-dimensional world. Citizens, consumers and workers require some knowledge of geometry. Much more knowledge is needed in occupations such as plumbing, carpentry, forestry, interior decorating, architecture and engineering. In addition then to acquiring knowledge of certain geometric concepts and properties and their applications, students need to develop their spatial and visualization skills.

The instructional content emphasizes exploration, activities, informal reasoning and the use of problem-solving skills. Much use is made of tools which aid in geometric explorations, including the compass, protractor, the straightedge, squared paper and the computer.

4.0: Geometry and Visualization Skills. Students recognize geometric patterns and relationships and apply them in solving problems and making predictions.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
4.1 RECOGNIZE AND USE GEOMETRIC PATTERNS, RELATIONSHIPS AND PRINCIPLES TO DESCRIBE AND CLASSIFY (ELS 1.5)	[a]Identify similar and different attributes of two or more geometric figures	[a]Identify properties of common geometric figures, including **quadrilaterals and geometric** solids	**[a]Identify distinguishing properties of common geometric figures including side or angle measurements**	[a]Identify and compare common two- and three-dimensional geometric shapes and solids according to attributes and properties
	[b]Identify, sketch, model **and manipulate** squares, rectangles, circles, triangles, cubes	[b]Draw or model simple, common geometrical figures with specific dimensions **using ruler, tangrams, squared paper or other concrete materials**	[b]Sketch or build common geometric solids and two-dimensional figures	[b]Model or make drawings of two- or three-dimensional shapes and solids useful in solving problems
	[c]Identify symmetry and geometric forms in the environment, **e.g., construction with colored tiles or cubes**	[c]Identify, sketch or model intersecting lines, right angles and lines of symmetry occurring in the environment	[c]Identify, sketch or model parallel and intersecting lines, right angles and lines of symmetry occurring in the environment	[c]Recognize and apply the concepts of symmetry, congruency and similarity of geometrical figures as commonly used in man-made objects
	[d]Copy or extend patterns using concrete models and drawing pictures	**[d]Copy or extend patterns using concrete models and drawing pictures**	**[d]Use drawings, models or computers to demonstrate geometric patterns and relationships such as similarity and congruence**	**[d]Use drawings, models or computers to demonstrate geometric patterns and relationships such as similarity and congruence**
		[e]Locate points on graph paper, maps and globes, and graph coordinates (emphasize examples from the environment)	[e]Locate and give coordinates of points on graph paper, maps, globes and other charts	[e]Locate points and lines and determine distance and area in a rectangular coordinate system **(emphasize examples from the environment and computer applications)**

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
			[f]Demonstrate by various means the relationships among radius, diameter and circumference of a circle, and the common right triangle relationships	[f]Apply and use circle and triangle relationships in solving problems
4.2 MAKE AND USE GEOMETRIC DRAWINGS AND MODELS, INCLUDING TESSELLATIONS	[a]Create simple constructions with tiles and copy on squared paper	[a]Find and use congruent polygons which will cover a surface without overlapping	[a]Explain why a flat surface can be completely covered without overlap, by congruent triangles, rectangles or squares	
		[b]Sketch top and side views of rectangular solids	[b]Use protractor, compass, ruler, computer and other instruments to make common geometric constructions	[b]Use protractor, compass, ruler, computer and other instruments to make common geometric constructions
		[c]Use cubes to build structures suggested by pictures and make 3-D shapes from paper patterns	[c]Draw the net (2 dimentional pattern) for common geometric solids (e.g., cube, rectangular prism, cylinder)	[c]Draw the net (2 dimentional pattern) for common geometric solids
4.3 UNDERSTAND AND USE PERIMETER, AREA AND VOLUME CONCEPTS	[a]Develop an understanding of perimeter, area and volume using concrete objects	[a]Develop an understanding of perimeter, area and volume using concrete objects	[a]Demonstrate, other than by using a formula, ways of finding perimeter and area of general triangles, circles, parallelograms and trapezoids	[a]Use and apply perimeter, area and volume concepts
	[b]Use common objects to estimate perimeter, area and volume	[b]Estimate and determine perimeter and area of rectangles, and volume of rectangular solids, by means other than formula	[b]Estimate and determine perimeter, area and volume of common geometric figures	[b]Estimate perimeter, area and volume

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
			[c]Use a formula for finding perimeter, area, and volume of rectangular solids	[c]Calculate perimeter, area and volume
			[d]Calculate surface areas of regularly shaped solids (e.g., cubes, cylinders, rectangular boxes)	[d]Calculate surface areas of regularly shaped solids (e.g., cubes, cylinders, rectangular boxes)

Measurement

Measurement concepts surround us. We use an understanding of measures to quantify and interpret the world. Modern technology is totally dependent upon measurement. Hidden in most of humanity's spectacular accomplishments are innumerable measurements, each related to or dependent upon a myriad of other measurements.

Measurement can be taught more successfully if estimation is a content objective. To teach measurement we should be concerned with more than a system of measures. We must teach a "doing" kind of mathematics. Activity gives meaning to measuring skills, makes the resultant learning personally satisfying to the pupil and begins the development of a process that will be used throughout life.

5.0: Measurement. Students measure quantities and use measurements to keep records, solve problems and make predictions.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
5.1 POSE AND SOLVE PROBLEMS THAT INVOLVE TIME AND MONEY	[a]Identify and order by value; make change using U.S. coins	[a]Identify and order by value, and make change using U.S. currency		
	[b]Read time using standard and digital clocks and order months, seasons and days of week	[b]Estimate elapsed time for given activities		
		[c]Create and solve problems which involve time or money	[c]Create and solve problems which involve time or money including consumer and wage earner situations of interest to students	[c]Create and solve problems which involve time and money, including consumer and wage earner situations of interest to students
5.2 SELECT AND USE APPROPRIATE INSTRUMENTS AND UNITS TO ESTIMATE AND MEASURE LENGTH-WEIGHT; VOLUME AND CAPACITY; AND TEMPERATURE (ELS 1.7)	[a]Estimate and determine length and weight (mass) using nonstandard, metric or English (U.S. Customary) units of measure and select and use appropriate instrument and unit for a measurement task	[a]Recognize and use meters, centimeters, feet, yards and inches to measure, and select the most appropriate instrument and unit for a measurement task	[a]Determine the most appropriate unit and instrument for a measurement task	[a]Determine the most appropriate unit and instrument for a measurement task
			[b]Estimate and directly measure distances, angles and other quantities, and indicate in some way the precision of the measurement, using metric and English (U.S. Customary)	[b]Estimate and directly measure length, area, volume, time, weight (mass), etc., with reasonable accuracy, and/or round a measurement to a given unit

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
		[c]Use squared paper, transparent grids, or other material to estimate area/perimeter of irregular closed figures	[c]Measure by some direct means the area of a polygon or some 2-D region with curves as boundaries, and the volume of 3-D objects	
			[e]Give examples of the importance of congruence and precision in society	
			[f]Explain why all measurements are approximations and why results of all computations with measurements are approximations	[f]Explain why all measurements are approximations and why results of all computations with measurements are approximations
	[g]Explore the concepts of weight (mass) using a balance scale and common classroom objects	[g]Estimate and determine the weight (mass) of common classroom objects in metric and English (U.S. Customary) units	[g]Estimate and determine the weight (mass) of common objects using metric and English (U.S. Customary) units	
	[h]Estimate, read and record temperature in C° and F°	[h]Estimate, read and record temperature in C° and F°	[h]Estimate, read and record temperature in C° and F° in real and given situations	
5.3 DETERMINE INDIRECT MEASUREMENTS (ELS 1.7)		[a]Locate points, give coordinates of points on maps and estimate distances between places represented by points on maps	[a]Make scale drawings and determine actual distances from scale drawings, blueprints, maps and globes	[a]Apply ratio and proportion concepts in making and using scale drawings and models, and in solving problems
			[b]Find and record measurements using proportions and formulas	[b]Find and record measurements using proportions and formulas

Statistics and Probability

We live in a society in which we are confronted daily with quantitative information or data. Statistics is the science or study of data. Quantitative literacy is a requirement for all educated individuals who want to be informed citizens and hold jobs in technical businesses and industries. Throughout life, decisions about health, citizenship, parenthood, employment, financial concerns and sports are based upon quantitative information. Statistics is most often concerned with using information in the face of uncertainty. Probability gives us a way to measure uncertainty.

In addition, studying statistics and probability can help in the development of students' critical thinking skills. In carrying out experiments, students develop ways to cope with uncertainty as they are searching for truth in a situation and learning to report it faithfully. Approaching situations statistically can help make students face up to their own prejudices, think more consistently about arguments, and justify their thinking with numerical information.

6.0: Statistics and Probability. Students collect, organize, record and interpret data and predict probable outcomes based on collected data.

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
Students will be able to:				
6.1 RECOGNIZE AND USE MATHEMATICAL PATTERNS, RELATIONSHIPS AND PRINCIPLES TO QUANTIFY PROBLEMS OR MAKE PREDICTIONS (ELS 1.6)	[a]Apply intuitive probability concepts; e.g., make predictions in games by using terms such as "more likely," "less likely," "fair," etc.	[a]Generate, record and interpret data from probability experiments and predict chances of an outcome	[a]Determine the number of possible events and the probability of an outcome in a probability experiment	[a]Interpret everyday uses of probability such as weather predictions, election forecasts or chances of winning a lottery
		[b]Recognize the concept of fair or unfair in game situations	[b]Identify and demonstrate situations in which probability or chance of an event occurring is likely, unlikely, equally likely; and whether a game is "fair"	[b]Identify and demonstrate situations in which probability or chance of an event occurring is likely, unlikely, equally likely; and whether a game is "fair"
		[c]Recognize certain (1) and impossible (0) probabilities	[c]Understand the meaning of probabilities of 0 (impossible) and 1 (certain)	
		[d]Use charts, tables and lists to organize all possible outcomes of an experiment	[d]Use charts, tables and lists to organize all possible outcomes of an experiment	
	[e]Collect and record data from picture graphs, bar graphs and charts to draw conclusions and make predictions	[e]Read, interpret, construct bar graphs, line graphs, tables and charts and make predictions based on them	[e]Read and interpret graphs, tables and charts and make predictions based upon them	[e]Read and interpret graphs, tables and charts, and make predictions based upon them
	[f]Make and use picture graphs and bar graphs	[f]Organize information into tables/charts and diagrams given appropriate scale, e.g., box plots, box-and-whiskers, line plots, Venn diagrams	[f]Make line and circle graphs for data meaningful to students	[f]Organize and display data using tables, charts, graphs and diagrams

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
		[g]Collect random samples	[g]Use data gathering procedures which will aid in answering questions of interest (conducting polls, sampling schemes)	[g]Use data gathering procedures which will aid in answering questions of interest (conducting polls, sampling schemes)
			[h]Understand the relationship between size of sample and degree of certainty	[h]Understand the relationship between size of sample and degree of certainty
			[i]Identify misleading or incorrect methods of displaying or interpreting data	[i]Identify misleading or incorrect methods of displaying or interpreting data
		[i]Read and interpret computer generated graphs and tables	[i]Use computer software to generate graphs and tables	[i]Use computer software to generate graphs and tables
			[k]Show the relationship among variables using tables, graphs, formulas and models	[k]Show the relationship among variables using tables, graphs, formulas and models
		[l]Predict simple possible future outcomes or actions	[l]Predict probable future outcomes or actions	[l]Defend conclusions from information given
			[m]Determine, interpret and compare advantages and disadvantages of mean, median and mode	[m]Collect, display, interpret statistical data using mean, mode, median, range and percentile

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
6.2 GENERATE AND TEST INTERPRETATIONS, EXPLANATIONS, PREDICTIONS AND HYPOTHESES (ELS 6.2)	[a]Identify facts that support an explanation and a prediction	[a]Identify parts of an explanation and a prediction not supported by fact	[a]Interpret differences between two explanations	[a]Critically analyze explanation and interpretation to confirm or validate them
	[b]Identify factors that may influence a behavior or a result	[b]Predict what influence different factors will have on a behavior or result	[b]Develop a hypothesis from observed data	[b]Develop a hypothesis using data from a variety of sources
	[c]Identify ways to determine whether a duplicate of an experiment will produce the same results	[c]Follow directions to conduct an experiment and identify the hypothesis used	[c]Gather data that confirms or negates a hypothesis	[c]**Design and conduct a test of a hypothesis and report the results**

Mathematical Relationships

Topics in this content strand are used to show how one thing changes as another changes. Formulas, tables and graphs often have close relationships to the "real world" and frequently can be used in making useful predictions. Ratio, proportion and percent are also used extensively in problem-solving situations. Program content emphasizes patterning, using logical thinking skills, modeling of concepts and real world applications.

7.0: Mathematical Relationships. Students recognize and use number patterns, relationships and logical thinking skills to make predictions and to solve problems.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
7.1 SORT AND CLASSIFY; USE LOGICAL THINKING (ELS 5.2)	[a]Sort and classify objects by attributes	[a]Classify objects and simple geometrical figures by attributes	[a]Classify geometrical figures and sets of numbers	[a]Classify geometrical figures and sets of numbers
		[b]Use evidence such as illustrations, examples, and verifiable sources to problem solve	[b]Use evidence from verifiable sources to support own ideas and concepts in problem solving	[b]Use evidence from verifiable sources to support own ideas and concepts in problem solving
		[c]Select and organize details to problem solve	[c]Select and use details, examples, illustrations, evidence and logic to problem solve	[c]Select and use details, examples, illustrations, evidence and logic to problem solve
		[d]Organize information or data using formats such as outlining, making maps, tables, charts and graphs	[d]Organize information or data using formats such as outlining, making maps, tables, charts, graphs; and computer spread sheets	[d]Organize information or data using formats such as outlining, making maps, tables, charts, graphs; and computer spread sheets
7.2 COMPREHEND MEANINGS OF WRITTEN, ORAL AND VISUAL COMMUNICATIONS INVOLVING NUMBER PATTERNS AND RELATIONSHIPS (ELS 3.1)	[a]State relationships using terms such as "greater than," "less than," and "equal to"	[a]State relationships using terms such as "greater than," "less than," and "equal to" and the symbols <, >, =	[a]Use equality and inequality concepts and symbols	[a]Use equality and inequality concepts and symbols
	[b]Relate new information to previous knowledge	[b]Relate new information to previous knowledge	[b]Relate new information to previous knowledge	[b]Relate new information to previous knowledge
	[c]Draw logical conclusions from information presented	[c]Draw logical conclusions from information presented	[c]Draw logical conclusions from information presented	[c]Synthesize information and draw conclusions

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
	[d]Find numerical patterns in charts and tables **e.g., 100-chart, addition and multiplication tables, and use number patterns and relationships to make predictions**	[d]Find numerical patterns in **100-charts and addition and multiplication tables (e.g., odd/even, primes, square numbers)**, and use patterns to complete simple charts and tables **and to make predictions** **[e]Explore relationships found in tables of value**	**[d]Find numerical patterns and use to complete charts and tables**	**[d]Find numerical patterns and use to complete charts and tables**
			[f]Recognize direct and indirect cause and effect relationships	[f]Infer direct and indirect cause and effect relationships
			[g]Show using models such as 100-grids, number lines or a meter stick how percent can be expressed as a fraction or decimal, and conversely	**[g]Demonstrate fraction, decimal, percent relationships**
			[h]Interpret and use the concepts of ratio, percent proportion and commonly occurring rates such as growth, speed and sports applications	[h]Interpret and use the concepts of ratio, percent and commonly occurring rates such as growth, speed, interest and cost per unit
7.3 RECOGNIZE, CONSTRUCT AND DRAW INFERENCES CONCERNING RELATIONSHIPS AMONG THINGS AND IDEAS (ELS 6.1)	[a]Identify characteristic of simple objects that remain the same even though some change occurs, **e.g., cutting** objects into two pieces			
	[b]Make a simple table of values given a specific rule and match a table of values to its rule	**[b]Make a simple table of values given a specific rule and match a table of values to its rule**	**[b]Evaluate or make a table for two-variable formulas which have meaning to students and match a graph or table of values to its formula**	**[b]Evaluate or make a table for two-variable formulas and match a graph or table of values to its formula**

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
		[c]Explore relationships illustrated in a table of values	[c]Describe the nature of change of each variable as suggested by a table of values, graph or formula	[c]Describe the nature of change of each variable as suggested by a table of values, graph or formula
7.4 REFLECT UPON AND IMPROVE OWN REASONING (ELS 6.6)	[a]Describe in simple terms how a solution was reached [b]Act upon suggestions for improving reasoning capabilities	[a]Describe the reasoning process being used	[a]Describe the strengths and weaknesses of inductive and deductive reasoning	[a]Present arguments supporting the use of deductive or inductive reasoning for a particular purpose

Oral and Written Communication Skills

Two emerging trends are reflected in "Common Curriculum Goals" for math; integration of learning across content areas, and the development and use of enabling skills which help students learn mathematics and other disciplines. The following strand, "Oral and Written Communication Skills," offers the basic communication skills needed to effectively read, discuss and share mathematical ideas and problems.

8.0: Oral and Written Communication Skills. Students use vocabulary, speech, numerals and other symbol systems essential for effective individual and group problem solving and for effective oral and written communication of mathematical concepts, problem-solving processes and results.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
8.1 RECOGNIZE **AND USE MATHEMATICS VOCABULARY** COMMONLY USED IN GRADE-LEVEL MATERIALS (ELS 1.1)	[a]Use phonetic analysis skills			
	[b]Use context clues in a paragraph to infer correct word(s)	[b]Use context clues in a passage to infer correct word(s)	[b]Use context clues in a selection to infer correct word(s)	[b]Use context clues in a selection to infer correct word(s)
	[c]Distinguish compound and plural words	[c]Distinguish affixes **and** root words	[c]Distinguish affixes **and** root words	[c]Distinguish affixes **and** root words
	[d]Use basic mathematical terms (such as sum, total, difference, product, less than, equal, greater than, **rectangle**) to convey concepts of quantity, order, operation, **and shape**	[d]Use mathematical terms to convey concepts of quantity, order, operation **and shape (e.g., product, factor, quotient, remainder, sum, quadrilateral)**	[d]Use basic mathematical terms and symbols to convey concepts of quantity, order, operation, **and shape**	[d]Use basic mathematical terms and symbols to convey concepts of quantity, order, operation, **and shape**
8.2 DETERMINE MEANING OF UNKNOWN WORDS COMMONLY USED IN **MATHEMATICAL** MATERIALS (ELS 1.2)	[a]Use adjacent words to infer meaning of unknown words	[a]Use context clues to infer meaning of unknown words	[a]Use context clues, punctuation and syntax to infer meaning of unknown words and concepts	[a]Use context clues, punctuation and syntax to infer meaning of unknown words and concepts
		[b]Recognize double meanings of words	[b]Recognize double meanings of words	[b]Recognize double meanings of words
	[c]Use knowledge of each part of a compound word to determine meaning	[c]Use knowledge of affixes and root words to determine word meanings	[c]Use knowledge of affixes and root words to determine word meanings	[c]Use knowledge of affixes and root words to determine word meanings
	[d]Use dictionaries and glossaries in grade-level curriculum materials	[d]Use context to determine correct dictionary definition of word	[d]Use dictionaries, glossaries and other reference materials to find word meanings	[d]Use dictionaries, glossaries and definitions in footnotes to find word meanings

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
8.3 SPEAK WITH STANDARD PRONUNCIATION, APPROPRIATE VOLUME, RATE, GESTURES AND INFLECTIONS (ELS 1.3)	[a]Produce correct basic speech sounds	[a]**Produce correct basic speech sounds**		
	[b]Pronounce words according to acceptable Standard English	[b]Pronounce words according to acceptable Standard English	[b]Pronounce words according to acceptable Standard English	[b]Pronounce words according to acceptable Standard English
			[c]**Make oral presentations that use verbal and nonverbal communication skills effectively**	[c]Make oral presentations that use verbal and nonverbal communication skills effectively
8.4 USE ORAL COMMUNICATION TO GIVE OR RECEIVE INFORMATION AND DIRECTIONS (ELS 2.3)	[a]Paraphrase oral messages	[a]Paraphrase oral messages	[a]Paraphrase oral messages	[a]Paraphrase oral messages
	[b]**Give accurate oral directions**	[b]Give accurate oral directions	[b]Give accurate oral directions	[b]Give accurate oral directions
	[c]Ask questions designed to clarify, gain assistance or local information	[c]Ask questions designed to clarify, gain assistance or local information	[c]Ask questions designed to clarify, gain assistance or local information	[c]Ask questions designed to clarify, gain assistance or local information
	[d]Share ideas and information orally with others	[d]Share ideas and information orally with others	[d]Share ideas and information orally with others	[d]Share ideas and information orally with others
	[e]**Provide accurate descriptive detail orally**	[e]Provide accurate descriptive detail orally	[e]Provide accurate descriptive detail orally	[e]Develop accurate detail based on oral explanations by others
		[f]Take notes based on oral presentations **and group discussions**	[f]Take notes **and prepare summaries** based on oral presentations **and group discussions**	[f]Take notes **and prepare summaries** based on oral presentations **and group discussions**
	[g]Follow 2-step oral instructions	[g]Follow 3-step oral instructions	[g]Follow multistep oral instructions	[g]Follow multistep oral instructions

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
8.5 DETERMINE THE SIGNIFICANCE AND ACCURACY OF INFORMATION AND IDEAS PRESENTED IN WRITTEN, ORAL, AURAL AND VISUAL COMMUNICATIONS (ELS 4.1)			[a]Separate between relevant and irrelevant information used to draw conclusions [b]Identify propaganda and other persuasion techniques **(e.g., use and misuse of statistics)**	[a]Distinguish between logical and illogical conclusions [b]Identify propaganda and other persuasion techniques **(e.g., use and misuse of statistics)**
8.6 USE ORAL COMMUNICATION TO INFLUENCE OTHERS AND TO RESPOND TO PERSUASION (ELS 4.2)	[a]Ask questions and draw reasonable conclusions from answers	[a]Provide logical answers based upon factual data [b]Use multiple sources to verify information	[a]Provide logical answers based upon factual data [b]Use multiple sources to verify information	[a]Provide logical answers based upon factual data [b]Use primary and secondary source materials to verify information [c]Argue opposite sides of issues [d]Recognize sources of persuasion and select appropriate persuasive response [e]Use verbal persuasion techniques in a class presentation
8.7 LISTEN, READ, VIEW AND EVALUATE PRESENTATIONS OF MASS MEDIA (ELS 4.4)			[a]Recognize persuasion techniques found in visual communications **(e.g., use and misuse of graphs)**	[a]Recognize **persuasion** techniques found in visual communications **(e.g., use and misuse of graphs)**

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
8.8 SELECT APPROPRIATE FORM OF WRITING (ELS 5.3)		[a]Write in a variety of forms such as reports, descriptions, **or in problem posing or solving** [b]Use writing appropriate to purpose such as to inform, **pose problems or solve problems**	[a]Write in a variety of forms such as personal essays, journals, reports, descriptions, **or in problem posing or solving** [b]Use writing appropriate to purpose such as to inform, **pose problems or solve problems**	[a]Write in a variety of forms such as personal essays, journals, reports, **descriptions, or in problem posing or solving** [b]Use **writing** appropriate to purpose **such as to inform, pose problems or solve problems**
8.9 PRESENT IDEAS IN UNDERSTANDABLE SEQUENCE ON THE TOPIC SELECTED (ELS 5.4)		[a]Write complete sentences	[a]Write complete sentences [b]Write multiparagraph **personal journals, reports or problem solution strategies**	[a]Write complete sentences [b]Write multiparagraph **personal journals, reports or problem solution strategies**
8.10 SELECT AND USE GUAGE, GESTURES AND SYMBOLS APPROPRIATE TO PURPOSE, TOPIC AND SETTING WHEN MAKING ORAL PRESENTATIONS (ELS 5.5)	[a]Select words which make the meaning clear	[a]Select words which make the meaning clear [b]Plan and make oral and visual presentations	[a]Use a variety of techniques and figurative expressions to convey meaning [b]Plan and make oral and visual presentations	[a]Employ verbal, symbolic, graphic and visual techniques to convey information meaning [b]Plan and make oral and visual presentations
8.11 EVALUATE AND REVISE OWN WRITING FOR MEANING, CLARITY AND COMPREHENSIVENESS (REVISING AND REWRITING) (ELS 5.6)	[a]Revise own writing to enhance clarity and meaning	[a]Revise own writing to enhance clarity and meaning [b]Use descriptive terms to emphasize facts **and quantities**	[a]Revise own writing to enhance clarity and meaning [b]**Use descriptive and connecting terms to enhance meaning, clarity and precision**	[a]Revise own writing for correctiveness and comprehensiveness [b]Use descriptive **and connecting** terms to enhance meaning, clarity and precision

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
8.12 APPLY THE CONVENTIONS OF WRITING TO PRODUCE EFFECTIVE COMMUNICATION (EDITING AND PROOFREADING) (ELS 5.7)	[a]Edit for capitalization, end punctuation and complete sentences	[a]Edit for **complete and** correct **sentences**, punctuation **and usage** [b]Spell correctly [c]Produce legible final copy	[a]Edit for complete and correct sentences, punctuation and usage [b]Spell correctly [c]Produce legible final copy (manual or electronic processes)	[a]Edit to produce a correct, legible, effective piece of writing [b]**Spell correctly** [c]**Produce legible final copy (manual or electronic processes)**

Appropriate Study Skills

It seems fitting that the ninth content strand be "Appropriate Study Skills." A full repertoire of study skills enables students to learn school mathematics efficiently while becoming independent learners. Only by reaching this level can students become life-long consumers and users of mathematics.

9.0: Appropriate Study Skills. Students select and use appropriate study skills in order to accomplish mathematical learning tasks.

KNOWLEDGE/SKILLS	*GRADE 3*	*GRADE 5*	*GRADE 8*	*GRADE 11*
Students will be able to:				
9.1 IDENTIFY MAIN IDEAS, SUPPORTING DETAILS, AND FACTS AND OPINIONS PRESENTED IN WRITTEN, ORAL AND VISUAL FORMATS (ELS 2.1)	[a]Locate facts in grade-level materials	[a]Locate facts in grade-level selections	**[a]Locate facts in grade-level selections**	**[a]Locate facts in grade-level selections**
		[b]Recall facts and supporting evidence	**[b]Identify necessary and extraneous facts and related supporting details**	**[b]Identify necessary and extraneous facts and related supporting details**
	[c]Identify main idea in a **problem situation**	[c]Identify main idea in a **problem situation**	**[c]Identify main idea in a problem situation**	**[c]Identify main idea in a problem situation**
9.2 USE INSTRUCTIONAL MATERIALS AS BASIS FOR GAINING KNOWLEDGE AND IMPROVING COMPREHENSION (ELS 2.2)	[a]Use table of contents to locate general and specific formation	[a]Use table of contents and index to locate general and specific information	[a]Use table of contents, index, summaries, charts, graphs and illustrations to locate information needed	[a]Use table of contents, index, summaries, charts, graphs and illustrations to locate information needed
		[b]Use supportive illustrations, detail and summations to obtain information	[b]Use organization of materials (summaries, headings and review questions)	[b]Use organization of materials (summaries, headings and review questions)
	[c]Use guide words in a dictionary or glossary to locate words	[c]Use diacritical markings or respellings to pronounce words	[c]Use diacritical markings or respellings to pronounce words	[c]Use diacritical markings or respellings to pronounce words
9.3 CLARIFY PURPOSES OF ASSIGNMENT (ELS 7.1)	[a]Determine general purpose of assignment and ask clarification on questions if necessary	[a]Determine general purpose of assignment and ask clarification on questions if necessary	[a]Determine general purpose of assignment and ask clarification on questions if necessary	[a]Determine general purpose of assignment and ask clarification on questions if necessary
	[b]Determine ideas and concepts addressed in the assignment	[b]Determine ideas, concepts and generalities addressed in the assignment	[b]Determine ideas, concepts, generalities or principles **included** in assignment	[b]Determine ideas, concepts, generalities or principles **included** in assignment

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
9.4 USE RESOURCES BEYOND THE CLASSROOM (ELS 7.2)		[a]Locate, check-out and return books and other circulating media materials	[a]Locate, check-out and return books and other circulating media materials	[a]Locate, check-out and return books and other circulating media materials
		[b]Locate and use noncirculating reference materials	[b]Locate and use noncirculating reference materials	[b]Locate and use noncirculating reference materials
		[c]Use library classification system and services to locate specialized resources required to complete assignments	[c]Use library classification system and services to locate specialized resources required to complete assignments	[c]Use library classification system and services to locate specialized resources required to complete assignments
			[d]Use computer, e.g., data bases, spread sheets	**[d]Use computer, e.g., data bases, spread sheets**
9.5 SELECT AND USE APPROPRIATE STUDY TECHNIQUES (ELS 7.3)	[a]Follow a study plan including: time management, appropriate study environment, processing of information	[a]Follow a study plan including: time management, appropriate study environment, processing of information	[a]Follow a study plan including: time management, appropriate study environment, processing of information	[a]Follow a study plan including: time management, appropriate study environment, processing of information
	[b]Accomplish learning task using appropriate study techniques (read and reread text, ask clarifying questions, seek help when needed, use memory **techniques**)	[b]Accomplish learning task using appropriate study techniques (preview and review chapters, read and reread text, ask clarifying questions, seek help when needed, use memory **techniques**, summarize, study with classmates, use self-questioning)	[b]Accomplish learning task using appropriate study techniques (preview and review chapters, read and reread text, ask clarifying questions, seek help when needed, use memory **techniques**, summarize, study with classmates, use self-questioning)	[b]Accomplish learning task using appropriate study techniques (preview and review chapters, read and reread text, ask clarifying questions, seek help when needed, use memory **techniques**, summarize, study with classmates, use self-questioning)
	[c]Vary reading rate according to purpose for reading the selection	[c]Vary reading rate according to purpose for reading the selection	[c]Vary reading rate according to purpose for reading the selection	[c]Vary reading rate according to purpose for reading the selection
	[d]Keep study materials organized and accessible	[d]Keep study materials organized and accessible	[d]Keep study materials, log and related notes organized and accessible	[d]Keep study materials, log, related notes and filing system organized and accessible

KNOWLEDGE/SKILLS	GRADE 3	GRADE 5	GRADE 8	GRADE 11
	[e]Turn in assignments on time	[e]Turn in assignments on time	[e]Turn in assignments on time	[e]Turn in assignments on time
	[f]Use appropriate test-taking techniques	[f]Use appropriate test-taking techniques	[f]Use appropriate test-taking techniques	[f]Use appropriate test-taking techniques